

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 August 2002 (01.08.2002)

PCT

(10) International Publication Number
WO 02/059410 A2

(51) International Patent Classification⁷: **D04H 1/00**

(US). SCHERTZ, David, M; 135 Taylor Ridge Court, Roswell, GA 30076 (US).

(21) International Application Number: PCT/US01/48896

(22) International Filing Date:

18 December 2001 (18.12.2001)

(74) Agent: NELSON MULLINS RILEY & SCARBOROUGH, L.L.P.; Keenan Building, Third Floor, 1330 Lady Street, Columbia, SC 29201-3332 (US).

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/257,827 22 December 2000 (22.12.2000) US
10/022,090 17 December 2001 (17.12.2001) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(71) Applicant: **KIMBERLY-CLARK WORLDWIDE, INC.** [US/US]; 401 North Lake Street, Neenah, WI 54956 (US).

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors: **WELCH, Howard, M**; 328 West Lane, Woodstock, GA 30188 (US). **SHULTZ, Jay, S**; 550 Woodline Court, Roswell, GA 30076 (US). **DOBBINS, Leslie, D**; 2709 Waymar Drive, Marietta, GA 30008 (US). **FITTS, James, R**; 8070 Bailey Mill Road, Gainesville, GA 30506 (US). **MORELL, Charles, J**; 10480 Turner Road, Roswell, GA 30076 (US). **WILLITTIS, Donald, V.**; 297 Senator Road, Douglasville, GA 30134 (US). **MORMAN, Michael, T**; 555 Kings Peak, Alpharetta, GA 30022 (US). **WEHNER, Jason, K**; 10213 S. Komensky Road, Apt. 1G, Oakland, IL 60453 (US). **RAWLS, Jessica, M**; 48 Simmons Drive, E., Flat Rock, NC 28726

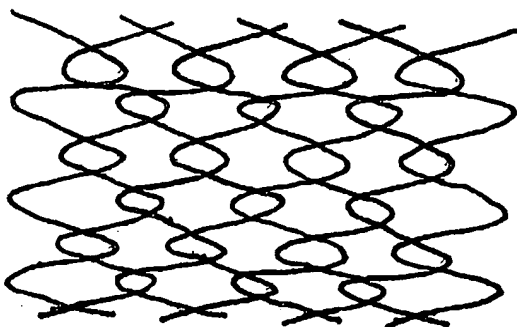
Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: LAMINATE AND WEB CHARACTERISTIC CONTROL BY VARYING BONDING PATTERNS

WO 02/059410 A2



(57) Abstract: New methods for and patterns of applying meltsprayed materials in single-layer web and laminate constructions so as to control various characteristics in the webs and laminates is provided. The patterns of adhesive produce scrim or cell-like patterns that allow for control of desirable characteristics. For example, the loft of a laminate may be enhanced, as well as strength properties.

**LAMINATE AND WEB CHARACTERISTIC CONTROL BY VARYING
BONDING PATTERNS**

The present application claims the benefit of U.S. Provisional Application Serial No. 60/257,827 filed December 22, 2000, which is
5 incorporated herein by reference thereto.

Field of the Invention

This invention relates to processes for creating desirable features in various laminates and webs by controlling the bonding patterns and
10 physical characteristics of various adhesives, and products produced thereby. Such webs and laminates may be used in a variety of applications such as diapers, athletic bandages, wipers, or other products that require features such as elasticity, loft, or strength.

Background of the Invention

15 Traditionally, nonwoven materials are formed by randomly spraying a molten material, such as a polyolefin, onto a moving web, such as a forming wire. Such processes produce desirably strong and soft materials at relatively low costs. Examples of such technologies include
20 meltblowing, spunbonding, meltspinning, solution spinning, carding, meltspraying and wet/dry air laying. One particular example of such nonwoven materials that may be used in personal care products such as disposable diapers is formed by a spunbonding process. Meltblowing, on the other hand, may be used to create webs having fine pore structures for increased opacity and/or fluid barrier protection. Such technologies
25 may be combined to form composite laminates such as spunbond/meltblown/spunbond ("SMS") materials. Such SMS materials have found particular uses as wipers, surgical gowns, and surgical dressings and an example of such material is described in U.S. Patent No. 4,041,203 to Brock et al.

30 Various other types of laminates may be formed from nonwoven

elastics and/or nonelastic materials. For example, composites of elastic and nonelastic nonwoven materials are commonly made by combining elastic and nonelastic webs in a lamination process to provide the entire composite with a degree of stretchability or elasticity. In addition, the loft, and thus the resulting softness, wicking ability, hooking ability, and absorbency, of various laminates may be controlled by varying the composition of webs from which the laminates are formed. These laminates and composites may then be used as the elastic and/or nonelastic components for various articles disposable personal care products such as, for example, diapers, pads, medical bandages, and the like.

Nonwoven materials that exhibit elastic properties may be produced by randomly spraying elastomeric polymers (instead of relatively non-elastic polyolefins) onto a moving web. Such nonwoven webs have little, if any, machine direction (MD) or cross-machine (CD) direction orientation. Examples of such elastomeric polymers include block copolymers such as polystyrene-polybutadiene-polystyrene (SBS) or polystyrene-polyisoprene-polystyrene (SIS), and Kraton® rubber. Although such randomly-oriented elastomeric polymer webs are highly effective in producing elastic nonwoven materials, their high cost generally makes them undesirable for many large-volume applications.

Typically, whether the laminate is elastic or nonelastic, an adhesive will be utilized to bond the various layers of the laminate together. The adhesive may, itself, be a separate functional layer or may, alternatively, be utilized merely to bond layers of the laminate together. For example, in an SMS laminate of the type mentioned above, the meltblown layer, which typically consists of very fine meltblown fibers, will act as both a functional barrier and as the adhesive to join the two outer spunbond facings together. On the other hand, extremely thin layers of meltblown may be used to bond two or more laminate layers together and the meltblown

layers may serve no functional purpose other than to act as the "glue" to hold the laminate together as a cohesive product.

When forming elastic composite laminates, a nonelastic material (or at least a less elastic material) is usually bonded to an elastic material (or at least a more elastic material) while the elastic material or sheet is in a stretched condition. The bond between the elastic and the nonelastic material may be created by the use of an adhesive that may consist of meltsprayed thermoplastic fibers. When the tension on the more elastic material is released in the bonded laminate, the less elastic component of the combination is allowed to gather in the spaces between the bonding sites. The resulting composite elastic material is stretchable to the extent that the less elastic material gathered between the bond locations allows the more elastic sheet to elongate. Examples of these types of composite laminate articles and materials are set forth in U.S. Patent Nos. 4,720,415 and 5,385,775, each of which is incorporated by reference herein.

In some stretchable laminate articles, elastic strands of continuous filaments are bonded to relatively inelastic sheet materials while the elastic strands are in a stretched condition. Such elastic continuous filaments may, in certain articles, be sandwiched between two or more relatively inelastic sheets. The relatively inelastic sheets may include nonwoven webs formed by meltblowing or spunbonding various polymers. Examples of such laminates are shown in U.S. Patent No. 5,385,775 to Wright, which is incorporated herein in its entirety by reference thereto.

In the manufacture of such laminates, adhesives have been used to hold elastic strands or entire webs in place, thereby bonding the elastic strands or webs to nonwoven facing materials. U.S. Patent No. 4,880,420 to Pomparelli discloses a method of applying adhesive to bond elastic strands to a fabric by using a sinusoidal-shaped line of adhesive. In Pomparelli, a relatively thick portion of adhesive is applied in a line along one or more elastic filaments in a direction generally parallel to the elastic

filaments. However, the line of adhesive disclosed in Pomparelli does not intersect itself at any point. Instead, the sinusoidal adhesive line intersects a predetermined number of the same elastic strands several times as the line winds its way across the strands.

5 Another adhesive pattern is illustrated in U.S. Patent No. 5,316,836 to Heindel et al., which is incorporated herein in its entirety by reference thereto. As shown in Figure 7 of the '836 patent, a semi-cycloidal pattern of hot-melt adhesive may be formed on a substrate and then attached to another layer. The adhesive may be arrayed in a configuration wherein
10 two or more adjacently located, semi-cycloidal patterns contact each other along adjacent marginal side sections 94 and 96. In other embodiments, the adjacent semi-cycloidal patterns may overlap by a discrete distance 93.

 One problem in the manufacture of laminate articles is that using
15 adhesives in random patterns often results in a laminate that does not exhibit characteristics of the laminate layers alone. For example, in diapers, excessive adhesive results in a stiff or inflexible diaper product that is undesirable to consumers. Also, if the adhesive is not applied in a preferred pattern, and is not efficiently utilized, it cannot reach optimum
20 performance to provide the greatest bonding strength for each gram of adhesive applied to the article. Thus, a challenge in making products of this type is to find ways to use less adhesive, but still impart sufficient bonding strength to securely fix elastic filaments into a nonwoven or to securely fix laminate layers together.

25 In addition, the enhancement of various other material properties such as loft, tensile strength, modulus, porosity, tactile feel, and visual appearance is always a highly sought after goal. For example, loft or bulk in a nonwoven laminate provides key attributes for garments such as disposable diapers, feminine and adult care products, health care
30 products such as disposable surgical gowns and the like. An increase in

tensile strength provides tear resistance to various garments. Moreover, an increase in porosity will provide for more comfort to the wearer when garments constructed from highly porous materials are worn. It would be desirable to exercise more control over such properties in laminate materials. It is to these and other aims that the present invention is directed.

Summary of the Invention

The present invention provides new methods for and patterns of applying meltsprayed materials in laminate constructions so as to control various characteristics in the laminates as well as new methods for forming elastic webs from non-elastic polyolefin resins. The articles in which the present invention may be utilized include various articles that require portions of elasticity, enhanced physical characteristics, etc. such as diapers, tampons, wipers, incontinence products, garments, gowns, feminine care products, health care products, and various laminate materials. Such articles will typically include one or more nonwoven layers bonded together with a meltspray material that is utilized as an adhesive. The meltspray material may, in addition to acting as an adhesive, also act as a functional layer.

The meltspray patterns that are applicable in the present invention are those that are formed from various overlapping strands of meltsprayed fibers. The degree of overlap, the particular patterns employed, the orientation characteristics of the fibers, and the particular fiber characteristics, such as fiber size and fiber weight, will create the desired characteristics in the inventive webs and laminates. In particular, by controlling the number of adhesive fiber streams per unit width, the frequency of the waves resulting from a meltsprayed fiber process, the orientation of the fibers, and the speed of lamination, various characteristics of the webs and the laminates can be altered.

In most of the bonding arrangements of the present invention, the

adhesive material fibers are applied in lines that intersect in order to form a bonding network comprised of both adhesive-to-laminate layer bonds and adhesive-to-adhesive bonds.

5 In certain embodiments of the present invention, the bulk or softness of the laminate is controlled by providing for zones of enhanced loft in the bonded laminate. In particular, meltsprayed fibers can be formed into interlocking cell-type arrays. The use of wave-shaped oscillating fiber sprays produce polymer streams that interlock after being sprayed to form an open, cell-like netting structure in the adhesive layer
10 that bonds adjacent laminate layers together. The controllability of the cell shape allows for specific, customized adhesive patterns to be made, thus resulting in the alteration of particularly chosen properties in the laminate structure.

15 In other embodiments, various physical characteristics of the polymers which form the open, cell-like, nettings can be varied so as to control laminate features. For example, the fiber sizes may be varied. Moreover, different types of materials may be utilized in the various polymer fibers that are utilized to form the nettings so that properties such as bondability, strength, heat latency, etc. can be altered or modified,
20 depending on the particular end uses.

In some embodiments, the lay-down orientation of the fibers is controlled so that the materials will have a relatively high degree of MD or CD orientation. Such patterns are also produced by overlapping oscillating fibers while they are still in their molten state, thus forming a
25 pseudo-knit structure.

In another aspect of the invention, a process of manufacturing an absorbent laminated article is utilized. The process comprises providing a nonwoven layer and spraying an adhesive upon the surface of the nonwoven layer, wherein the adhesive is applied to the nonwoven layer in
30 a predetermined, non-random pattern that is capable of providing certain

characteristics to the laminate structure.

Other objects, advantages and applications of the present invention will be made clear by the following detailed description of embodiments of the invention and the accompanying drawings wherein reference numerals

5 refer to like or equivalent structures.

Brief Description of the Drawings

Figure 1 is a cross-sectional side view of an exemplary laminate having an example of the inventive adhesive scrim bonding two facings together;

10 Figure 2 illustrates the frequency/width relationship of an adhesive bonding fibers of the present invention;

Figure 3 represents an exemplary bonding pattern of the present invention;

15 Figure 3A shows a prior art bonding pattern that employs adhesive fibers that do not intersect in any kind of cell arrangement;

Figure 3B shows another exemplary adhesive bonding spray or scrim pattern;

Figure 3C shows another exemplary adhesive bonding spray or scrim pattern;

20 Figure 4 illustrates another adhesive bonding or scrim pattern similar to that of Figure 3;

Figure 5A illustrates a swirled type of adhesive bonding pattern;

Figure 5B shows a randomized adhesive bonding pattern having a majority of adhesive lines in the CD direction;

25 Figure 6A is a photomicrograph showing the random orientation of fibers in an exemplary prior art spunbond material; and

Figure 6B is a photomicrograph showing the CD orientation of fibers in an highly oriented, elastic, nonwoven material of the present invention.

Definitions

5 The term "continuous filaments", as used herein, refers to strands of continuously formed polymeric filaments. Such filaments will typically be formed by extruding molten material through a die head having a certain type and arrangement of capillary holes therein.

10 The term "elastic" or "elasticized", as used herein, refers to a material which, upon application of a biasing force, is stretchable, which is elongatable to at least about 60 percent (i.e., to a stretched, biased length which is at least about 160 percent of its relaxed unbiased length), and which will recover at least 55 percent of its elongation upon release of the stretching force. A hypothetical example of an elastic material would be a one (1) inch sample of a material which is elongatable to at least 1.60 inches and which, when released, will recover to a length of not more than 15 1.27 inches. Many elastic materials may be elongated by more than 60 percent (i.e., more than 160 percent of their relaxed length). For example, some elastic material may be elongated 100 percent or more, and many of these will recover to substantially their initial relaxed length such as, for example, within 105 percent of their original relaxed length upon release of the stretching force.

20 As used herein, the term "polymer" generally includes, but is not limited to, homopolymers, copolymers, such as, for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications thereof. Furthermore, the term "polymer" includes all possible geometrical configurations of the material, such as isotactic, 25 syndiotactic and random symmetries.

The term "composite nonwoven fabric", "composite nonwoven", "laminate", or "nonwoven laminate", as used herein, unless otherwise defined, refers to a material having at least one layer of sheet material 30 joined to at least one other layer of sheet material. Such composites may

have, but are not required to have, a gatherable layer which is bonded to an elastic layer or material so that the gatherable layer may be gathered between bonding locations. This type of composite elastic laminate is disclosed, for example, in U.S. Pat. No. 4,720,415 to Vander Wielen et al.,
5 which is incorporated herein in its entirety by reference thereto. In nonelastic laminates, the layers of sheet material will not necessarily be gatherable and may not be elastic at all.

As used herein, the term "nonwoven web" refers to a web having a structure of individual fibers or threads that are interlaid, but not in an identifiable, repeating manner. Nonwoven webs have been, in the past,
10 formed by a variety of processes such as, for example, meltblowing processes, spunbonding processes and bonded carded web processes.

As used herein, the term "meltblown fibers" means fibers formed by extruding a molten thermoplastic material through a plurality of fine,
15 usually circular, die capillaries as molten thermoplastic material or filaments into a high velocity gas (e.g., air) stream which attenuates the filaments of molten thermoplastic material to reduce their diameter, which may be to microfiber diameter. Thereafter, the meltblown fibers are carried by the high velocity gas stream and are deposited on a collecting
20 surface to form a web of randomly disbursed meltblown fibers. Such a process is disclosed, for example, in U.S. Patent No. 3,849,241 to Butin, which is incorporated herein in its entirety by reference thereto.

As used herein, the term "spunbonded fibers" refers to small diameter fibers formed by extruding a molten thermoplastic material as
25 filaments from a plurality of fine, usually circular, capillaries of a spinnerette with the diameter of the extruded filaments then being rapidly reduced as by, for example, eductive stretching or other well-known spun-bonding mechanisms. The production of spun-bonded nonwoven webs is illustrated in patents such as, for example, U.S. Patent Nos. 4,340,563 to
30 Appel et al., and 3,692,618 to Dorschner et al. The disclosures of these

patents are incorporated herein in their entireties by reference thereto.

As used herein, "scrim" refers generally to a fabric or nonwoven web of material which may be elastic or inelastic, and having fibers lying in a machine direction ("MD") oriented along the path of manufacture and fibers oriented and lying in a cross-machine direction ("CD"). Heretofore, elastic scrims made from meltblown processes inherently create a MD-oriented material.

Detailed Description of the Invention

Reference now will be made to the embodiments of the invention, one or more examples of which are set forth below. Each example is provided by way of explanation of the invention, not as a limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in this invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the appended claims and their equivalents. Other objects, features and aspects of the present invention are disclosed in or are obvious from the following detailed description. It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions.

The present invention provides new methods for and patterns of applying meltsprayed materials in web and laminate constructions so as to control various characteristics in the laminates. The articles in which the present invention may be utilized include various articles that require portions of elasticity, enhanced physical characteristics, etc. such as diapers, tampons, wipers, and various laminate materials. Such articles

will typically include one or more nonwoven layers bonded together with a meltspray material that is utilized as an adhesive. The meltspray material may, in addition to acting as an adhesive, also act as a functional layer. In one such embodiment, the meltspray material is a relatively highly oriented nonwoven material wherein the meltsprayed fibers have been oriented primarily either in the MD and/or in the CD direction so that the resulting web is relatively elastic.

In the present invention, various meltsprayed adhesive patterns may be formed by overlapping strands of adhesive meltsprayed fibers. The degree of overlap, the particular patterns employed, and the particular fiber characteristics, such as fiber size and fiber weight, will be employed to create the characteristics desired in the inventive nonwoven webs and laminate products. By controlling the number of adhesive fiber streams per unit width, the frequency of the waves resulting from a meltsprayed fiber process, the width of the waves, the ratio of the frequency to the width of the waves, the overall orientation of the fibers, and the speed of lamination, various characteristics of the laminate can be altered.

In particular, the present invention may be utilized in order to allow orientation of the meltsprayed fibers in either the MD, CD, or equally in the MD and CD. This aspect is different than in current meltblown processes for making elastic scrims where MD-oriented material is inherently created.

In Figure 1, an exemplary laminate 10 employing the inventive bonding pattern is shown. In the exemplary construction of laminate 10, two outer facings 12 and 14, which for example may both be spunbond materials, are bonded together by an elastic scrim 16. Although two facings are shown bonded together by the inventive bonding adhesive pattern, it is to be understood that a scrim material may be utilized in conjunction with only one laminate layer so that one facing forms a laminate in conjunction with the inventive adhesive scrim.

Figure 2 shows a single adhesive fiber strand and illustrates various characteristics that may be varied in order to obtain the desired traits in the scrim patterns utilized in the present invention. As shown in Figure 2, the length "L" between peaks of the fiber strand may be considered the frequency of the oscillating wave of the fiber strand. The width "W" from the bottom of a peak to the top of the peak is also illustrated. In order to obtain optimum performance of the adhesive bonding pattern, the bonding fibers may have their frequencies (or lengths "L") varied, their widths "W" varied, or the ratio of L to W (L/W) varied.

Figures 3 and 4 illustrate exemplary scrims having multiple overlapping adhesive fibers. As shown particularly in Figure 3, four strands of fibers interlock to produce the scrim (fibers A, B, C, and D). The oscillating pattern of adhesive fibers are shown interlocked. By controlling the frequency, width, and proximity of the scrim's fibers, scrims can be produced that either have a additional strength in the MD direction, the CD, or equally in both directions.

Other exemplary bonding patterns are illustrated in Figures 3B, 3C, and 5A. Such patterns all share the similar feature of overlapping fibers -- either upon themselves (as shown in Figure 5A) or upon one or more of the other adhesive fiber strands (as shown in Figures 3 and 4).

One particular means of applying adhesives in the laminates utilizes meltblown spray technology. In this technology, meltblowing equipment has typically presented the adhesive to the facings in the laminates in a random fibrous configuration. Multiple adhesive-to-facing and bonds per unit length of facing are formed, along with multiple facing to facing adhesive bonds per unit area. In general, strong, flexible adhesive bonds are required to maintain the flexibility and integrity of the laminate in use. If the adhesive-to-facing bonds are too few in number or are too weak, then the tension properties of the laminate will be compromised.

The common remedy in prior art processes for remedying this condition was to increase the number of bonding sites by either increasing the meltspray air pressure, or by slowing the lamination speed. As the meltspray air pressure is increased, the resulting adhesive fiber size is reduced in these known processes, creating weaker bonds. Increasing the amount of adhesive used per unit area to create larger adhesive filaments usually repairs this, but this usually increases the cost of the laminate. Lowering the lamination speed decreases machine productivity, but negatively impacts product cost.

Typically, when laminates are formed, one or more facings of sheet material are brought together after one or both of the facings have been sprayed or coated with an adhesive. Then, the facings, having the adhesive mounted to at least one of the facings (or in some embodiments, both of the facings) are brought together adjacent one another with pressure being applied to join the laminated facings together in a cohesive product. However, the present invention is not limited to any particular process of forming the laminates, provided the inventive adhesive bonding patterns are employed in the laminates.

The lamination process employed in the present invention may operate at high speeds. In fact meltspray processes running at 1500 feet per minute ("fpm") or more may be utilized.

The adhesives are applied according to the present invention in a continuous, wave-shaped pattern so that individual fibers adhesive strands intersect each other in a predominantly perpendicular fashion. The bonding of the continuous adhesive filaments to each other to form the inventive nettings, or scrim, is also controlled to a known number per unit length so that predictable and controllable laminate properties are achieved. The adhesives may be applied with known meltspray technology, or with modified versions thereof that allows individual or groups of individual meltspray adhesive fiber strands to be oscillated so as

to form the inventive interlocking wave patterns. The adhesive employed to bond the sheet(s) will be applied to one or more of the laminate sheet layers by using a stationary spray head capable of forming the predetermined pattern or by using moving, or oscillating, nozzle(s) that are designed to follow the predetermined pattern path required for the adhesive line. Various equipment for applying the adhesive lines of the present invention may be utilized and the invention is not limited to any particular apparatus. Such technology is within the purview of those having ordinary skill in the present art and the description of such equipment and meltspray adhesive-forming processes are unnecessary.

Various types of adhesives may be employed in the present invention, including those having elastomeric properties such as styrene block co-polymer based adhesives that are available from the ATO-Findley Adhesives Company. Another class of polymers that may be utilized in the present process as the meltspray adhesive when an elastic scrim is needed, are tackified blends of Kraton® elastomeric polymers distributed by Shell Chemical Company. Various Kraton polymers may be utilized, including, but not limited to, the Kraton G Series of polymers. Other exemplary elastomeric materials that may be used include tackified polyurethane elastomeric materials such as those available under the trademark ESTANE from B.F. Goodrich & Co., polyamide elastomeric materials such as those available under the trademark PEBAX from the Rilsan Company, and polyester elastomeric materials such as those available under trade designation HYTREL from E.I. DuPont De Nemours & Company.

However, the present invention is not limited to this or any particular polymer or material from which to form the meltspray adhesive. For example, various materials, including the following, may be used: polypropylene, polyethylene, polyesters, polyethylene terephthalate, polybutane, polymethylidene, ethylenepropylene co-polymers,

polyamides, tetrablock polymers, styrenic block copolymers, polyhexamethylene adipamide, poly-(ϵ -caproamide), polyhexamethylenesebacamide, polyvinyls, polystyrene, polyurethanes, thermoplastic polymers, polytrifluorochloroethylene, ethylene vinyl acetate polymers, polyetheresters, polyurethane, polyurethane elastomerics, polyamide elastomerics, polyamides, and various viscoelastic hot melt pressure sensitive adhesives. In addition, such materials may be utilized to meltspray single-constituent, bi-constituent, and bi-component adhesive fibers within the scope of the presently described invention.

The materials that are utilized to form the melt-spray adhesive may have sufficient tackiness to enhance the bonding strength of the laminate by allowing a degree of autogenous bonding. For example, the polymer itself may be tacky when formed into fibers and/or filaments or, alternatively, a compatible tackifying resin may be added to the sprayable compositions described above to provide tackified adhesive fibers that autogenously bond. Various known tackifying resins and tackified compositions may be employed, such as those described in U.S. Patent No. 4,787,699, which is incorporated herein in its entirety by reference thereto.

Any tackifier resin can be used that is compatible with the adhesive polymer and can withstand the meltspraying process conditions. Generally, hydrogenated hydrocarbon resins exhibit enhanced temperature stability and, thus, may be desirable tackifiers. REGALREZTM hydrocarbon and ARKONTM series tackifiers are examples of hydrogenated hydrocarbon resins. ZONATAKTM 501 lite is an example of a terpene hydrocarbon. REGALREZTM hydrocarbon resins are available from Hercules Incorporated. ARKONTM series resins are available from Arakawa Chemical (U.S.A.) Incorporated. Of course, the present invention is not limited to use of such tackifying resins, and other tackifying resins that are compatible with the other components of the composition

and that can withstand the processing conditions may also be used.

By changing the compositions of one or more of the individual adhesive fiber strands utilized to form the presently-described cell-like arrays, a multitude of material properties can be controlled.

5 The sheet materials that may be utilized as the various laminate layers of the present invention include nonwoven webs such as meltblown webs, spunbond webs, or carded webs, woven webs, or a film material. In one particular embodiment, polypropylene spunbond facings having a basis weight of approximately 0.4 ounces per square yard ("osy") may be employed.

10 The materials utilized to form the meltspray adhesive fibers may also be utilized in forming the outer facings of the presently described laminate. In particular, various webs may be utilized that are formed from elastomeric or nonelastomeric fibers. Various polyester elastic materials are, for example, disclosed in U.S. Patent No 4,741,949 to Morman et al., which is incorporated herein in its entirety by reference thereto. Other useful elastomeric polymers also include, for example, elastic copolymers of ethylene and at least one vinyl monomer such as, for example, vinyl acetates, unsaturated aliphatic monocarboxylic acids, and esters of such

15 monocarboxylic acids. The elastic copolymers and formation of elastomeric fibers from these elastic copolymers are disclosed in, for example, U.S. Patent No. 4,803,117, which is also incorporated herein in its entirety by reference thereto.

20 The facing(s) of the present invention may be a mixture of elastic and nonelastic fibers or particulates. For example, U.S. Patent No. 4,209,563 is incorporated herein in its entirety by reference thereto and describes the process by which elastomeric and nonelastomeric fibers are commingled to form a single coherent web of randomly dispersed fibers. Another example of such an elastic composite web is shown in U.S.

25 Patent No. 4,741,949, which is also incorporated herein in its entirety by

reference thereto wherein an elastic nonwoven material is described as including a mixture of meltblown thermoplastic fibers and other materials. The fibers and other materials may be combined in the forming gas stream in which the fibers are borne so that an intimate entangled commingling of fibers and other materials, e.g., wood pulp, staple fibers or particulates such as, for example, activated charcoal, clays, starches, or hydrocolloid (hydrogel) particulates, occurs prior to collection of the fibers upon a collecting device to form a coherent web of randomly dispersed fibers

Various processing aids may also be added to the polymers utilized in the present invention (either in the facings or in the meltspray adhesives). Useful blending polyolefin materials include, for example, polyethylene, polypropylene and polybutene, including ethylene copolymers, propylene copolymers and butene copolymers. A particularly useful polyethylene may be obtained from the U.S.I. Chemical Company under the trade designation Petrothene NA 601 (also referred to herein as PE NA 601 or polyethylene NA 601). Two or more of the polyolefins may be utilized.

In general, the adhesive bonds in the present laminate are regulated per unit area by the application system such that key properties such as stretch and elongation can be controlled to precisely match product performance needs. This invention allows for the optimization of the adhesive and facings in the laminate, thus providing a preferred match of laminate properties and laminate cost. Laminate properties that can be more precisely adjusted with this invention include the softness or drapability of the material--a minimal amount of adhesive can be utilized to provide a less rigid structure. Further, the laminate tension characteristics can be better tailored to product requirements using this invention because the adhesive bonds can be prescribed and/or predetermined within the laminate. Thus, a minimal number of the adhesive bonds can be used in certain embodiments to allow more flexibility in the laminate.

Laminate elongation and retraction properties also may be designed to meet product needs by controlling the number of adhesive bonding sites. The amount of laminate bulk, as described below, may be also be modulated since the retraction and resulting buckling of the facings can be controlled due in part to the ability to regulate the number of adhesive bond sites and the size and number of cell openings in the adhesive scrim.

The overall basis weight of the laminate can vary, but in many applications is between about 2 and 4 osy. In one particular embodiment, the basis weight is between about 2.85 and about 3.2 osy.

In certain embodiments of the present invention, the bulk or softness of the laminate is controlled by providing for zones of enhanced loft in the bonded laminate. The enhanced loft is created where the laminated layers do not come into contact with the adhesive material.

Such processes may provide zones of controlled loft in both film/nonwoven and nonwoven/nonwoven laminates as well as various laminates employing woven sheet materials.

By proper choice of the substrates and the laminate stretch conditions, controlled loft may be further enhanced to allow for additional softness, visual distinctiveness, Velcro hook attachment areas, absorbency, and dryness. Controlled loft is particular valuable in laminated products such as diapers where softness and bulk are valuable.

In particular, in this embodiment, the cell shapes of the netting material can be designed to be essentially symmetrical in shape, or can be elongated in either the CD or MD direction by controlling the process setup and run conditions. In this manner, the controllability of cell shape allows for specific, customized adhesive patterns to be made.

In other embodiments, various physical characteristics of the polymers which form the open, cell-like, nettings can be varied so as to

control laminate features. For example, the fiber sizes may be varied. Moreover, different types of materials may be utilized in the various polymer fibers that are utilized to form the nettings so that properties such as bondability, strength, heat latency, etc. can be altered or modified, depending on the particular end uses. Moreover, the particular compositions from which individual fibers may be varied as described above.

When an elastic web is desired as part of the laminate material, such elastic webs may be produced according to the teachings of the present invention. Although more expensive elastic materials, such as the elastomeric compositions described above, may be utilized to provide the elasticity, when lower cost alternatives are needed the fiber pattern orientation techniques of the present invention may be utilized instead.

An elastic nonwoven web may be produced from suitable non-elastic polyolefin materials such as polyethylene and polypropylene by arranging the meltsprayed fibers in an orientation that is either primarily in the MD and/or CD direction. An example of such lay-down pattern is shown in Figure 6B. As contrasted to the fiber orientation shown in the prior art spunbond web of Figure 6A, the primarily CD-oriented fibers provide elasticity without the need for elastomeric compositions. The elastic web of Figure 6B has a pseudo-knit macro-structure, and exhibits an approximate 33% elongation with little evidence of stress relaxation. By manipulating the structure of the nonwoven web, a low-cost, elastic, fiber web is produced.

EXAMPLES

The following examples describe various embodiments of the invention. Other embodiments within the scope of the claims herein will be apparent to one skilled in the art from consideration of the specification or practice of the invention as disclosed herein. It is intended that the specification, together with the examples, be considered to be exemplary

only, with the scope and spirit of the invention being indicated by the claims which follow the examples.

Example 1

5 Two spunbond facings made from polypropylene and then "necked" so as to be wider at the ends and narrower thorough a middle portion. A Findley-brand elastic material designated as KX-2695-01 was meltsprayed through an ITW-brand meltspray head. The particular ITW-brand head had eight 1"-wide nozzles arranged so as to have a hole density per
10 nozzle of 10 per inch. The elastic adhesive was sprayed onto one of the necked spunbond facings which was then pressed to the other necked spunbond facing in a smooth steel roll on rubber nip in order to produce the cohesive laminate.

The adhesive bonding pattern utilized was a netting construction
15 with a high degree of CD orientation.

A total of eight laminates were made according to this process. The resulting laminates were elastic in the cross-machine direction only since the necked spunbond facings were extensible in the CD direction.

Example 2

20 An SMS laminate having a controlled loft was created as follows. The laminate was bonded utilizing a meltsprayed material created by an 8"-wide ITW-brand adhesive spray head. The ITW head had 8 nozzles, with each nozzle having 5 adhesive capillaries per inch. The bonding scrim produced by this equipment was a CD oriented netting type pattern.

25 The adhesive utilized was a Rextac 2730 resin available from Huntsman Polymers Corporation of Odessa, Texas, and having a basis weight of 5 grams per square meter ("gsm"). The outer spunbond facings were a 0.5 ounces per square yard ("osy") basis weight polypropylene
30 material. Meltblown layers utilized in the present examples were

meltblown layers having basis weights of 0.3 osy and 0.5 osy, respectively. The laminate was formed at a rate of 300 feet per minute ("fpm").

5 The resulting laminates exhibited a regular, controlled, patterned loft as set by the adhesive scrim pattern utilized.

Example 3

10 A highly structured (versus randomly-placed fiber) nonwoven web was produced as follows. A polypropylene resin (PF-015, available from Montel, Inc.) was applied to a moving web of release paper with a band of overlapping Omega oscillating spray nozzles. The nonwoven web produced a nonwoven having a high degree of CD orientation like the material shown in Figure 6B.

Example 4

15 Another highly structured nonwoven web was produced as follows. A 3:1 polymer blend (by weight) of polypropylene (PF-015, available from Montel, Inc.) and E-33 amorphous poly-alpha olefin (APAO) (available from Huntsman Chemical Co.) was applied to a moving web via a modified Omega meltspray head. The APAO softened the resulting polypropylene material in order make it less brittle and lower the melt viscosity, but
20 allowed the resulting nonwoven to retain sufficient strength for end uses. The modifications to the Omega spray head included an additional row of oscillating nozzles that were off-set to the adjacent row, thus resulting in more uniform coverage of the polymer. The resulting nonwoven material was an elastic web having an approximate 33% elongation, with little
25 evidence of stress relaxation.

30 It is to be understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions. The invention is shown by example in the appended claims.

WHAT IS CLAIMED IS:

1. A nonwoven material comprising:
individual polymer fibers arranged in a predefined pattern wherein
adjacently-located individual fibers overlap to form an organized structure
5 and wherein said predefined pattern has the majority of said individual
fibers lying in either a machine-direction orientation, a cross-machine
direction orientation, or both a machine-direction and cross-machine
direction orientation so as to form an organized structure of polymer fibers.
- 10 2. The nonwoven material of claim 1 wherein said predefined
pattern is a scrim.
3. The nonwoven material of claim 1 wherein said polymer
fibers comprise elastomeric fibers.
- 15 4. The nonwoven material of claim 1 wherein said polymer
fibers comprise non-elastomeric fibers.
5. The nonwoven material of claim 1 wherein said predefined
pattern of individual fibers comprises fibers that overlap themselves in a
semi-cycloidal pattern.
- 20 6. The nonwoven material of claim 1 wherein said material is
an adhesive layer capable of joining two or more layers of material
together in a laminate construction.
7. The nonwoven material of claim 1 wherein a majority of
individual fibers or oriented in both the machine-direction and in the cross-
machine direction.
- 25 8. The nonwoven material of claim 1 wherein said polymer
fibers comprise polyolefins.
9. A laminate comprising:
at least two facings adhered together by an adhesive layer;
said adhesive layer comprising individual polymer fibers arranged in a
30 predefined pattern wherein adjacently-located individual fibers overlap to

- form an organized structure and wherein said predefined pattern has the majority of said individual fibers lying in either a machine-direction orientation, a cross-machine direction orientation, or both a machine-direction and cross-machine direction orientation so as to form an organized structure of polymer fibers.
- 5 10. The laminate of claim 9 wherein said polymer fibers comprise elastomeric fibers.
11. The laminate of claim 9 wherein said polymer fibers comprise non-elastomeric fibers.
- 10 12. A nonwoven material comprising:
individual polymer fibers arranged in a predefined pattern wherein at least of said fibers are joined to create an overlapping bonded structure.
13. The nonwoven material of claim 12 wherein said fibers are joined thermally.
- 15 14. The nonwoven material of claim 12 wherein said fibers are continuous filaments.

1/6

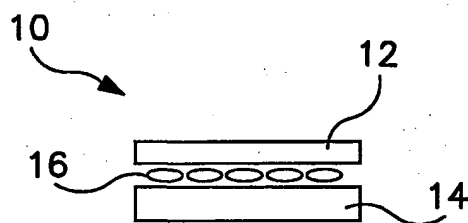


FIG. 1

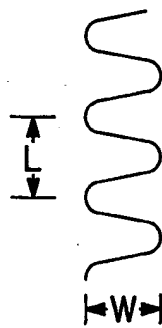


FIG. 2

2/6

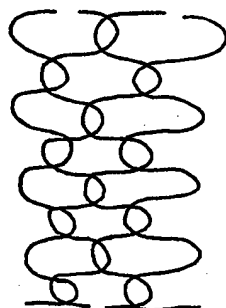


FIG. 3

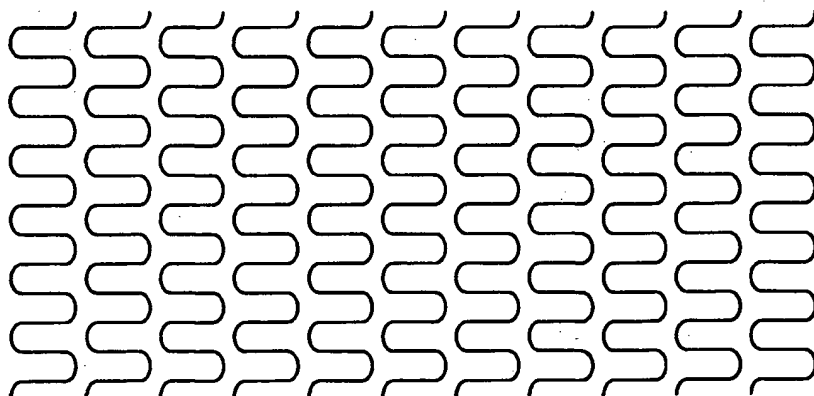


FIG. 3A

(PRIOR ART)

3/6

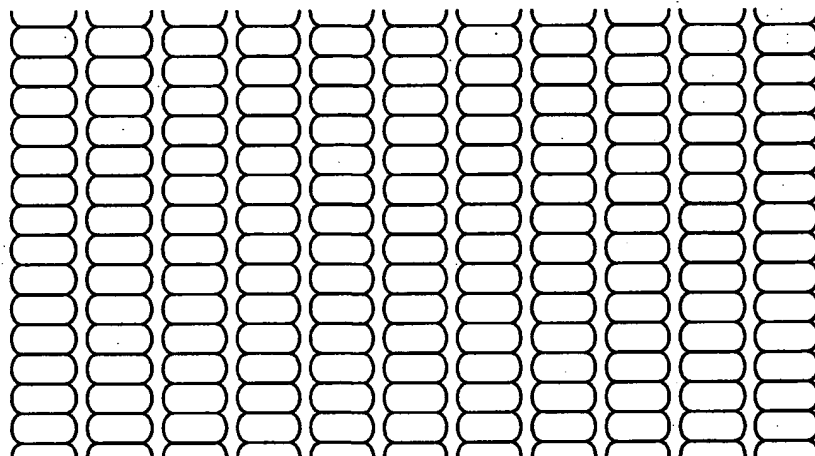


FIG. 3B

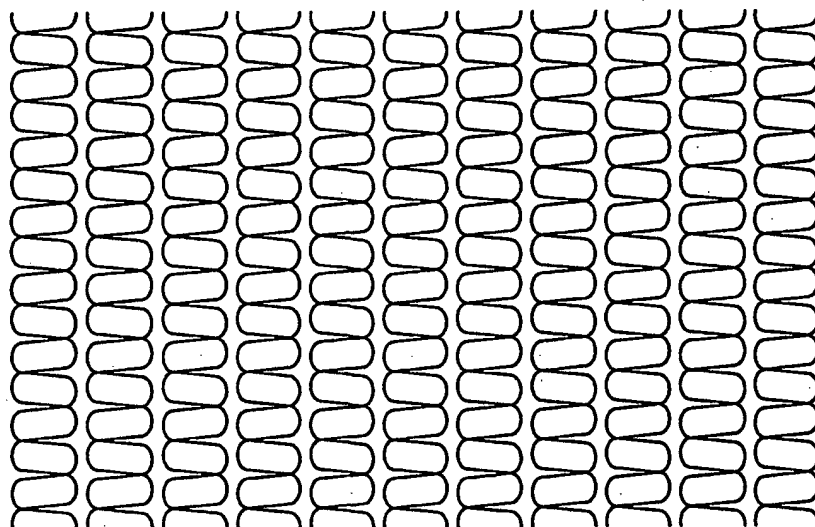


FIG. 3C

4/6

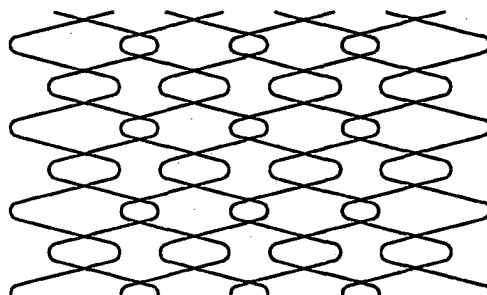


FIG. 4

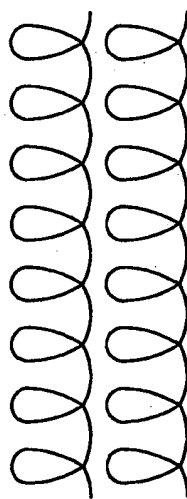


FIG. 5A

5/6

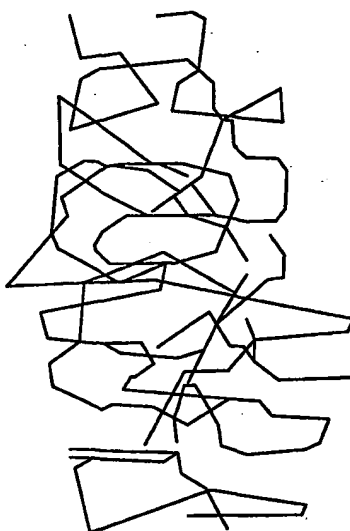


FIG. 5B

6/6

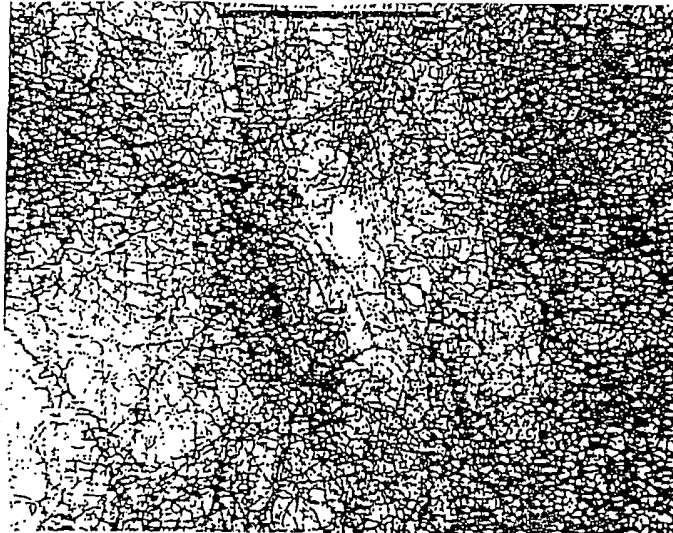


FIG. 6A
PRIOR ART

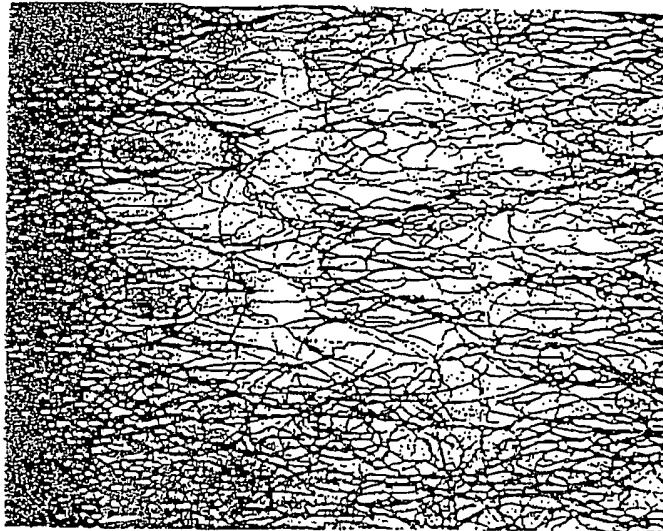


FIG. 6B

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 August 2002 (01.08.2002)

PCT

(10) International Publication Number
WO 02/059410 A3

(51) International Patent Classification⁷: **B32B 5/26**,
31/00, 7/14, D04H 13/00, 3/05, 3/04

(US). SCHERTZ, David, M; 135 Taylor Ridge Court,
Roswell, GA 30076 (US).

(21) International Application Number: PCT/US01/48896

(74) Agent: NELSON MULLINS RILEY & SCARBOROUGH, L.L.P.; Keenan Building, Third Floor, 1330 Lady Street, Columbia, SC 29201-3332 (US).

(22) International Filing Date:
18 December 2001 (18.12.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/257,827 22 December 2000 (22.12.2000) US
10/022,090 17 December 2001 (17.12.2001) US

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MY, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— with international search report

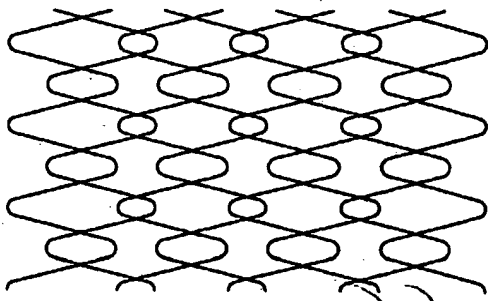
(88) Date of publication of the international search report:
23 January 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(71) Applicant: **KIMBERLY-CLARK WORLDWIDE, INC.** [US/US]; 401 North Lake Street, Neenah, WI 54956 (US).

(72) Inventors: **WELCH, Howard, M**; 328 West Lane, Woodstock, GA 30188 (US). **SHULTZ, Jay, S**; 550 Woodline Court, Roswell, GA 30076 (US). **DOBBINS, Leslie, D**; 2709 Waymar Drive, Marietta, GA 30008 (US). **FITTS, James, R**; 8070 Bailey Mill Road, Gainesville, GA 30506 (US). **MORELL, Charles, J**; 10480 Turner Road, Roswell, GA 30076 (US). **WILLITTIS, Donald, V**; 297 Senator Road, Douglasville, GA 30134 (US). **MORMAN, Michael, T**; 555 Kings Peak, Alpharetta, GA 30022 (US). **WEHNER, Jason, K**; 10213 S. Komensky Road, Apt. 1G, Oakland, IL 60453 (US). **RAWLS, Jessica, M**; 48 Simmons Drive, E., Flat Rock, NC 28726

(54) Title: LAMINATE AND WEB CHARACTERISTIC CONTROL BY VARYING BONDING PATTERNS



(57) Abstract: New methods for and patterns of applying melsprayed materials in single-layer web and laminate constructions so as to control various characteristics in the webs and laminates is provided. The patterns of adhesive produce scrim or cell-like patterns that allow for control of desirable characteristics. For example, the loft of a laminate may be enhanced, as well as strength properties.

WO 02/059410 A3

International Application No
PCT/US 01/48896

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B32B5/26 B32B31/00 B32B7/14 D04H13/00 D04H3/05
D04H3/04

B. FIELDS SEARCHED

IPC 7 B32B D04H B05C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Creation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 08998 A (PROCTER & GAMBLE) 24 February 2000 (2000-02-24) figure 13 ---	1-14
X	GB 2 252 047 A (KAO CORP) 29 July 1992 (1992-07-29) figure 5 ---	1-14
X	EP 0 757 127 A (POLYMER PROCESSING RES INST ;NIPPON PETROCHEMICALS CO LTD (JP)) 5 February 1997 (1997-02-05) figures 2,7,9,13,15 ---	1,8, 12-14
X	EP 0 678 607 A (NIPPON PETROCHEMICALS CO LTD) 25 October 1995 (1995-10-25) the whole document ---	1-4,6-14
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

^o Special categories of cited documents :

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

*T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

*X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

*& document member of the same patent family

Date of the actual completion of the International search

14 August 2002

Date of mailing of the international search report

22/08/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Barathe, R.

INTERNATIONAL SEARCH REPORT

ational Application No

PCT/US 01/48896

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 01 87589 A (KIMBERLY CLARK CO) 22 November 2001 (2001-11-22) the whole document ---	1-14
P,X	WO 01 87213 A (KIMBERLY CLARK CO) 22 November 2001 (2001-11-22) figures 12A,12C,,14A-14D ---	1-14
P,X	EP 1 065 047 A (UNI CHARM CORP) 3 January 2001 (2001-01-03) column 1, paragraph 1 - paragraph 2; figures ---	1-14
P,X	EP 1 065 046 A (UNI CHARM CORP) 3 January 2001 (2001-01-03) figure 3 ---	1-14
P,X	EP 1 090 617 A (UNI CHARM CORP) 11 April 2001 (2001-04-11) paragraph '0001! - paragraph '0002! figure 4 ---	1-14
X	JP 09 087954 A (DAIWABO CO LTD) 31 March 1997 (1997-03-31) figures ---	1-4,6-14
X	& PATENT ABSTRACTS OF JAPAN vol. 1997, no. 07, 31 July 1997 (1997-07-31) & JP 09 087954 A (DAIWABO CO LTD), 31 March 1997 (1997-03-31) abstract ---	1-14
P,X	JP 2001 329460 A (NIPPON PETROCHEM CO LTD) 27 November 2001 (2001-11-27) figure 8 ---	1-14
P,X	& PATENT ABSTRACTS OF JAPAN vol. 2002, no. 03, 3 April 2002 (2002-04-03) & JP 2001 329460 A (NIPPON PETROCHEMICAL CO LTD), 27 November 2001 (2001-11-27) abstract ---	1-14
P,X	JP 2001 009947 A (POLYMER PROCESSING RES INST;NIPPON PETROCHEM CO LTD) 16 January 2001 (2001-01-16) the whole document ---	1-4,6-14
P,X	& PATENT ABSTRACTS OF JAPAN vol. 2000, no. 16, 8 May 2001 (2001-05-08) & JP 2001 009947 A (NIPPON PETROCHEMICAL CO LTD), 16 January 2001 (2001-01-16) abstract ---	1-4,6-14
A	DE 196 47 458 A (MILDENBERGER & WILLING VERPACK) 20 May 1998 (1998-05-20) figure 1 ---	1-14
	-/--	

INTERNATIONAL SEARCH REPORT

ational Application No
PCT/US 01/48896

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with Indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 346 928 A (KIMBERLY CLARK CO) 20 December 1989 (1989-12-20) cited in the application column 15, line 17 - line 33; figures 6,7,10 ---	1-13
A	US 4 880 420 A (POMPARELLI VINCENT) 14 November 1989 (1989-11-14) cited in the application figures ---	1-14
A	US 5 785 696 A (INOUE YASUSHI ET AL) 28 July 1998 (1998-07-28) figures 1,2,3E ---	1-14
A	US 5 932 284 A (REYNOLDS GARY MACK) 3 August 1999 (1999-08-03) figure 3 -----	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

PCT/US 01/48896

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0008998	A	24-02-2000	AU 5478399 A BR 9912952 A CN 1312696 T CZ 20010341 A3 EP 1115322 A1 HU 0103178 A2 NO 20010702 A TR 200100408 T2 WO 0008998 A1	06-03-2000 25-09-2001 12-09-2001 17-10-2001 18-07-2001 28-11-2001 09-02-2001 21-09-2001 24-02-2000
GB 2252047	A	29-07-1992	HK 115896 A JP 2872851 B2 JP 5038350 A US 5395359 A	12-07-1996 24-03-1999 19-02-1993 07-03-1995
EP 0757127	A	05-02-1997	EP 0757127 A1 US 5840633 A WO 9617121 A1 US 6048808 A	05-02-1997 24-11-1998 06-06-1996 11-04-2000
EP 0678607	A	25-10-1995	JP 7300763 A JP 7290566 A EP 0678607 A2 US 5645933 A	14-11-1995 07-11-1995 25-10-1995 08-07-1997
WO 0187589	A	22-11-2001	AU 5977701 A WO 0187589 A2	26-11-2001 22-11-2001
WO 0187213	A	22-11-2001	US 2002007164 A1 AU 5985701 A WO 0187213 A1	17-01-2002 26-11-2001 22-11-2001
EP 1065047	A	03-01-2001	JP 2001009960 A AU 4274100 A CA 2312613 A1 CN 1286968 A EP 1065047 A1	16-01-2001 05-04-2001 29-12-2000 14-03-2001 03-01-2001
EP 1065046	A	03-01-2001	JP 2001011769 A CN 1290776 A EP 1065046 A1	16-01-2001 11-04-2001 03-01-2001
EP 1090617	A	11-04-2001	JP 2001095837 A AU 6131900 A CN 1292253 A EP 1090617 A2	10-04-2001 05-04-2001 25-04-2001 11-04-2001
JP 09087954	A	31-03-1997	NONE	
JP 2001329460	A	27-11-2001	NONE	
JP 2001009947	A	16-01-2001	CN 1277273 A EP 1054092 A1	20-12-2000 22-11-2000
DE 19647458	A	20-05-1998	DE 19647458 A1	20-05-1998
EP 0346928	A	20-12-1989	US 4949668 A AU 618816 B2	21-08-1990 09-01-1992

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/48896

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0346928	A		AU 3639289 A	21-12-1989
			CA 1316336 A1	20-04-1993
			DE 68926066 D1	02-05-1996
			DE 68926066 T2	14-11-1996
			EP 0346928 A2	20-12-1989
			ES 2085263 T3	01-06-1996
			JP 2104354 A	17-04-1990
			JP 3032212 B2	10-04-2000
			KR 131337 B1	14-04-1998
			MX 166873 B	10-02-1993
			US 5342647 A	30-08-1994
			ZA 8904216 A	26-09-1990
US 4880420	A	14-11-1989	AT 40849 T	15-03-1989
			AU 575988 B2	11-08-1988
			AU 4627585 A	20-02-1986
			BR 8503818 A	20-05-1986
			CA 1257751 A1	25-07-1989
			DE 3568300 D1	30-03-1989
			EP 0172037 A1	19-02-1986
			ES 546183 D0	01-04-1987
			ES 8704335 A1	16-06-1987
			GR 851980 A1	13-12-1985
			JP 1985966 C	08-11-1995
			JP 6104110 B	21-12-1994
			JP 61083301 A	26-04-1986
			NZ 212997 A	31-07-1987
			PT 80967 A	01-09-1985
			SG 32889 G	22-09-1989
			ZA 8506254 A	25-03-1987
US 5785696	A	28-07-1998	JP 8196559 A	06-08-1996
			DE 59606242 D1	01-02-2001
			EP 0724870 A2	07-08-1996
US 5932284	A	03-08-1999	AU 4598197 A	11-05-1998
			WO 9816181 A1	23-04-1998
			ZA 9709004 A	23-04-1998